resist the swelling of the fuel, irradiation damage resistance, and attractive nuclear properties. Vanadium-base alloys are preferred for this application although niobium-base alloys and duplex tubing are of interest. Fabrication of high-quality small-diameter tubing of these more exotic jacket materials has been difficult. Disposable-powder core extrusion and ductile core-drawing techniques being developed have been studied, along with mechanical properties, compatibility, and corrosion resistance of these alloys.

$(U,Pu)O_2$ fuel is amenable to several fabrication techniques. Pressing and sintering of high-density pellets, powder filling and swaging of high-density rod, and vibratory compaction of graded powders are methods of producing rod-type fuel elements of the mixed oxide. These methods have been studied in detail, as have their adaptability for remote operation from the standpoint of dealing with high Pu-240 concentrations. The physical properties of the $(U,Pu)O_2$ fuel are important. Stainless steels are attractive jacket materials for $(U,Pu)O_2$; other high-strength alloys for containing released fission gases, however, could also be of interest.

(U,Pu)C fuel is adaptable to the same ceramic fabrication techniques as the oxide. Increased chemical activity of this material over the oxide requires careful atmospheric control. The methods for synthesis of the carbide include direct reaction of molten plutonium and graphite. Vibratory compaction of powders is an important method of fabrication particularly when remote operation is considered, although pressing and sintering are important in producing high-density bodies. The use of stainless steel as a jacket material for (U,Pu)C is desirable from many standpoints. This material, however, may not satisfy compatibility requirements. Alternative jacket materials such as vanadium alloys and duplex tubing utilized for metallic fuels are applicable here.

Cermet fuels, using UO_2 or PuO_2 as the dispersed fuel phase, have potential for fast-reactor application. Where high breeding ratio is desired, uranium or thorium alloy can be used as the fertile matrix material; but where it is not, stainless steel can be used as a nonfertile matrix. Methods have been investigated for the fabrication of pin and plate elements.

Thorium-base alloys containing uranium have exhibited potential as fuel. This fuel is amenable to fabrication by casting into small-diameter rods and by working methods such as extrusion, swaging and rolling. Thorium/Plutonium and Th/U/Pu alloys also have potential as fast fuels.

In all cases, the physical and mechanical properties of both fuel and cladding are important in the fabrication processes and economics.